

Migratory behaviour of bats at south Swedish coasts

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From marking and recoveries, it has long been known that some bat species migrate between summer and winter haunts, e.g. *Myotis dasycneme*, *Myotis lucifugus* (e.g. EGSBAEK and JENSEN 1963; DAVIS and HITCHCOCK 1965). It has also been shown that some species undertake long distance seasonal north-south migrations, e.g. *Miniopterus schreibersi*, *Nyctalus noctula*, *Pipistrellus nathusii*, *Vespertilio murinus* in Europe and, e.g. *Tadarida brasiliensis*, *Myotis sodalis* in North America (AELLEN 1983; GRIFFIN 1970; MASING 1988, 1989; PETERSONS 1990; STRELKOV 1969; YALDEN and MORRIS 1975). It is also well known that bats are able to cross the sea since several species have been reported from many more or less remote islands, oil rigs and ships (BAAGØE and BLOCH 1994; PETERSEN 1994; STANSFIELD 1966). Among these records, migratory species prevail.

We know from marking that at least some bats on the Scandinavian peninsula are migratory (GERELL 1987). Two *Pipistrellus nathusii* marked in Skåne were recovered in Ger-



Fig. 1. Investigated sites at the south coasts of Öland, Blekinge, Skåne.

1. Ottenby (56°12'N, 12°24'E); 2. Torhamn; 3. Utklippan; 4. Uttorp; 5. Lindö; 6. Gödde; 7. Kåsehuvud;
8. Ystad, Revnäbbet; 9. Skivarpsån; 10. Hörte hamn; 11. Smygehuk; 12. Smygehuk light-house;
13. Falsterbo channel; 14. Falsterbo, Nabben (55°22'N, 12°49'E). Most observations on migratory behaviour were made in the period 25 August–10 September in 1993–1996. The local summer faunas were studied in July and early August.

many and Belgium. One *Nyctalus noctula* marked in Skåne was recovered in Germany. Because of the lack of a land connection to the continent in the south, these bats have to fly across the sea.

Data on regular bat migration across the sea, however, seem to be scarce or absent. The aim of this study was to investigate if it is possible to observe migrating bats by locating the sites where they leave land at the south Swedish coasts. This might be a first step in obtaining better knowledge of migratory behaviour.

A number of points and peninsulas along the south Swedish coasts of the provinces Skåne, Blekinge and Öland were selected from the map (Fig. 1). These localities were visited to find out whether there was any accumulation of bats or if any bats passing or leaving the shore actually could be observed.

The observation method was the use of ultrasound detectors (Pettersson Elektronik D-980, D-140, D-240) with tape recorder for documentation and subsequent analysis (Sony TCD-D7). Visual observations on flight behaviour and directions were possible with the aid of a strong 12 V halogen spot-light. Species identification was made according to methods described in AHLÉN (1981, 1990). When the bats had been discovered, mainly by the detector, they could often be followed over long distances with the visible light.

Unpublished data from the marking of bats at Pape bird station at the Baltic coast in south Latvia (PETERSONS 1990) were essential to find the right time of the year, namely when the peak number of bats was attained.

For four years, 1993–1996, the selected sites were visited during the time when migrating bats could be expected, mainly in late August and early September. Most of the sites were also visited during the non-migration period in the summer to investigate which species belonged to the local fauna of the nearby areas.

Increased bat activity with species not belonging to the local summer fauna occurred at almost all the studied sites. A total of 1175 bats belonging to 12 different bat species was observed (Tab. 1). The species dominating in numbers was *Pipistrellus nathusii*. On some occasions, hundreds of this species were observed, while there were fewer representatives of all other species.

At two localities, Ottenby and Falsterbo, bats leaving land were observed (*Pipistrellus nathusii*, *Nyctalus noctula*, *Vespertilio murinus*) while no migration out over the sea was seen at any of the other coastal sites. At Kåsehuvud, a remarkable concentration of many bats of several species was found on two occasions but no migratory movement out over the sea was detected.

The following remarks on the observed bat species can be made:

Pipistrellus nathusii was the dominating species, despite being rare in Sweden, being observed at 10 of the 14 sites. At Ottenby, the approximate numbers observed accumulating and/or passing each night were (numbers of bats seen leaving land in brackets) 50, 30(3), 30, 3, 200, 250, 20, 30(30), 14(2), 4(1), 100(5), 1. At Falsterbo, numbers observed were 4(4), 5(5), 0, 0. During one night at Kåsehuvud, there were approximately 50 specimens in the area. The migrating bats observed at Ottenby arrived early in the evening, all of them following approximately the same route out over the sea at a height of only 2–3 m, with directions due south or a few degrees more to the west. On some evenings with strong winds, many bats accumulated over the open seashore (on the west side of the point) but took off when the wind-force fell. During gales, irrespective of wind direction, no bats appeared over the seashore. The migrating bats left land one by one, and no groups or flocks could be seen outside the aggregations over the shoreline. At Segerstad (north of Ottenby on the east coast of Öland), one bat was seen on 25 August 1996 in the morning by an ornithologist when it was coming in from the sea. The bat flew straight into a bird net and was identified as *Pipistrellus nathusii* (C. CEDERROTH, pers. comm.). *Pipistrellus pipistrellus*. This species most often belonged to the local summer fauna but

Table 1. Bat observations at 14 sites. Total number of bats observed at each site (the maximum number observed on one occasion is given in brackets) and number of occasions when the species was observed. *Mm/b* = *Myotis mystacinus* or *brandtii*, *Mnat* = *Myotis daubentoni*, *Mdau* = *Myotis daubentoni*, *Vmur* = *Vespertilio murinus*, *Enil* = *Eptesicus nilssonii*, *Eser* = *Eptesicus serotinus*, *Nnoc* = *Nyctalus noctula*, *Nlei* = *Nyctalus leisleri*, *Ppip* = *Pipistrellus pipistrellus*, *Pnat* = *Pipistrellus nathusii*, *Bbar* = *Barbastella barbastellus*, *Paar* = *Plecotus auritus*.

	<i>Mm/b</i>	<i>Mnat</i>	<i>Mdau</i>	<i>Vmur</i>	<i>Enil</i>	<i>Eser</i>	<i>Nnoc</i>	<i>Nlei</i>	<i>Ppip</i>	<i>Pnat</i>	<i>Bbar</i>	<i>Paar</i>	No of spec.
Ottenby	2(1)2	2(2)1	26(20)4	1(10)2	17(4)8	1(1)1	13(10)4		97(20)10	703(250)12	2(2)1	1(1)1	11
Torhamn									20(20)1	4(4)1			2
Utklippan	6(6)1								1(1)1				1
Uttorp		1(1)1			5(5)1				20(20)1	5(5)1			5
Lindö		1(1)1							1(1)1				2
Göudde													0
Kåsehuvud				6(3)2	1(10)2		11(11)1	1(1)1	25(20)2	54(50)2			6
Ystad							2(1)2		28(23)3	2(2)2	2(2)1		4
Skivarpsån										1(1)1			1
Hörte hamn			10(10)1		4(2)3				4(3)2				3
Smygehuk				1(1)1	7(4)3		1(1)1		3(3)1	3(2)2			5
S. light-house				1(1)1	5(2)4		1(1)1		3(3)1	5(5)1			5
Falsterbo channel			2(2)1						5(5)1	5(3)2			3
Falsterbo				3(1)1	4(2)2		5(4)2		9(4)3	9(5)2			5
All sites, totals.	8	3	39	22	53	1	33	1	219	791	4	1	

occurred in large numbers and frequently flew out over the seashore. At Utklippan island (15 km from the mainland) one individual was found feeding there one evening in September. One specimen was also found dead in the grass on Utklippan on 12 May 1995 (G. STRÖMBERG, pers. comm.).

Nyctalus noctula was regular in small numbers at Ottenby, Falsterbo and Kåsehuvud with the maximum number of 11 specimens observed at Kåsehuvud, but was observed in small numbers at three other sites. Migrating specimens leaving land were observed at Falsterbo and Ottenby (one bat on each site). They left land early in the evening and flew much higher than *P. nathusii*, approximately 10 m above the water. The dates chosen for observations were not optimal for this species which probably has its migration peak somewhat later in the autumn. Some efforts to find this peak have failed so far. Large flocks of noctules flying in daylight in October have been reported from Skåne and some coastal areas more to the north. One noctule marked in Sweden was recovered in Germany. The species is definitely migratory within Sweden but is also known to hibernate in southern Sweden, so the extent to which Swedish noctules really leave the country is unknown (GERELL 1987, and pers. comm.). One specimen found hanging on a bush thorn at Utklippan, but still alive, was released on 27 May 1980 (G. STRÖMBERG, pers. comm.).

Nyctalus leisleri. One specimen was observed and recorded when hunting over the grass hills of Kåsehuvud on 30 August 1993. This was the first find of the species in Sweden. Most likely *N. leisleri* have been sited earlier at 3 or 4 localities in southern Skåne.

Vespertilio murinus was observed at Ottenby, Kåsehuvud, Smygehuk, and Falsterbo. On one evening at Ottenby two bats from a group of 5 were seen to fly away over the sea. At Falsterbo one specimen was observed leaving land in the evening. It flew at a height of about 10 m and disappeared in a southwesterly direction.

Myotis daubentoni was observed flying over the sea water surface at Ottenby, Uttorp, Hörte hamn, Smygehuk, and over the sea outside the Falsterbo channel. At least some of these bats were feeding and it was impossible to judge whether they were migratory or had just temporarily moved into the area for feeding.

Eptesicus nilssoni was observed regularly but in small numbers at almost all sites. At least at some sites the occurrence clearly exceeded what could be expected from nearby local fauna.

One specimen of *Eptesicus serotinus* was observed and recorded when flying around near the light-house at Ottenby on 27 August 1993. This was the first Swedish record of the species outside Skåne. Since then, in 1996, it has also been observed on northern Öland (AHLÉN 1997).

Two specimens of *Barbastella barbastellus* were observed and recorded when flying around the entire area, including the open seashore, at Ottenby on 6 September 1994. Two specimens were also observed at Ystad on 27 August 1996. In both cases the species did not belong to the local summer fauna.

This study showed that most of the selected sites at the south coast of Sweden had increased bat activity at the expected time of migration and dispersal. In some cases, real concentrations of many bats not belonging to the local summer fauna accumulated, swarming over the seashore. Bats actually leaving land and disappearing out over the sea were observed in three species. Altogether 12 bat species occurred at the selected sites which, at least to some extent, would be an expression of regional movements or migratory instinct in most of these species.

The remarkable accumulation of bats at Kåsehuvud can probably be explained by the shape of the coastline. Following the coast, the bats may find that the shore deviates too much from their innate migration direction there. It is also probable that the high south-facing slopes provide good feeding habitats for bats. The question is then if they, after some hesitation, continue along the coast or migrate across the sea at this site.

Thus, migrating bats leaving land for flights across the sea have been observed at Ot-

tenby and Falsterbo. It is, however, likely that bats leave land at more places somewhere between these two localities, e.g. Kåsehuvud. The bat *Pipistrellus nathusii*, which is the most numerous migrant observed in this study, has a flight speed of about 20 km/h (= 5.6 m/s) (BAAGØE 1987). If they maintain the course they had when they left Ottenby, they would reach the Polish coast after flying 180 km for about 9 hours. When starting in the evening they will reach land the next morning in daylight. The distance to Bornholm is about 140 km (about 7 hours). However, the flight directions do not indicate that they are aiming for Bornholm. It is not even likely that the bats leaving Ottenby come to the coast of Blekinge, because only small numbers of bats have been observed at Torhamn and at Utklippan there are only a few records of bats but none of this species. There are a few direct observations reported to the author of bats coming in from the sea in spring, namely at Ottenby (C. CEDERROTH, pers. comm.) and at Torhamn (M. JONASSON, in lit.). In both cases, these bats came in full daylight, which would be expected with a departure time from the southern Baltic coast early the preceding evening.

Obviously, bats regularly migrate across the Baltic Sea from Öland and Falsterbo or other points along the coasts. This migration can certainly involve problems, as indicated by an observation reported from Skagen, the northernmost point of Denmark. Along a 200 m sandy shore about 10 dead bats were found on 16 September 1994, following several days with strong easterly winds (D. NILSSON according to M. FORSLUND, in lit.). The bats observed in spring at Torhamn and Ottenby were apparently exhausted, as was the bat found dead in the grass on Utklippan.

Pipistrellus nathusii is a rare species in Sweden. Apart from a few older records in southwestern Skåne published by RYBERG (1947), it has just recently been found in some areas in south and middle Sweden (AHLÉN and GERELL 1990; LUNDBERG and GERELL 1994). Especially the number of bats observed at Ottenby, with hundreds of specimens accumulating and swarming at the shore, exceeds what could be expected from the known very small populations within Öland (AHLÉN 1997). Could it be possible that these bats come in from the Baltic states, or are there still unknown populations in Sweden? *Pipistrellus nathusii*, marked and observed migrating at the Pape bird station in Latvia, follow the coast and have never been observed to migrate out over the sea (G. PETERSONS, pers. comm.). On the other hand, there is one observation from the east coast of Öland of a *Pipistrellus nathusii* coming in from the sea. The species has been able to colonize and establish a small population on Gotland (AHLÉN 1983, 1994). Until further data on migration have been secured, the origin of bats passing Ottenby remains to be determined.

This study has shown that migratory behaviour in several species is indicated by accumulation of many bats at certain points of south Swedish coasts but also by direct observation of bats flying out over the sea. Some bats carry out long-distance migrations and regularly have to cross the Baltic Sea for up to about 9 hours' flight. There are clear indications, however, that this effort may be risky, namely the many bats obviously hesitating before departure and the exhausted or dead bats found at the seashores.

The occurrence of the 12 species indicates that the division in migratory and resident species is perhaps not so sharp. These observations, together with other observations recently made in Sweden, show that some of the most resident species also perform population movements between summer and winter habitats, perhaps much more than has been expected.

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